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Research Article

Valuing ecosystem services of community gardens in developing countries: a case study of Dezful City in Iran

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Abstract

Allotment (AGs) and community gardens (CGs) are types of urban gardens that provide diverse ecosystem services (ESs) such as climate regulation, beautiful landscapes, biodiversity and food security. Despite this, there are no AGs or CGs in many developing countries such as Iran. One of the main reasons for the lack of development of CGs in developing countries is the lack of proper understanding by policy-makers and citizens regarding the economic value of the ESs provided and the lack of disclosure of the benefits of its construction in urban areas. The purpose of this study is to analyse the preferences of citizens, to examine the existence of a potential market, to estimate the willingness to pay (WTP) for the creation and operation of CG services and to investigate the factors affecting residents' WTP in Dezful, Iran. For this purpose, a choice experiment, based on the stated preferences valuation approach, was applied through interviews with 170 respondents living in Dezful urban area. The data were collected during the autumn of 2022 and analysed using conditional logit model. The results indicated that the responding citizens are willing to pay 4.57 USD per month to create CG and operate its ESs in Dezful. Amongst the attributes and ESs of the community garden, citizens valued cultural services the most, followed by provisioning services. In addition, the variables "age", "being native", "education", "household expenditure level" and "awareness and recognition of CG ecosystem services" had a significant effect on WTP. According to the results, it is suggested to follow the policy of creating CGs with the participation of citizens instead of focusing only on the creation of urban green space with a government budget and heavy financial burden. CGs, while providing diverse ESs, can generate sustainable incomes for municipalities and accelerate the movement toward sustainable urban development.

Key words: choice experiment, community garden, economic valuation, ecosystem services, urban green space

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Introduction

The world population will reach 10 billion people by 2050, two-thirds of whom will live in cities (Alivand 2022). The expansion of urbanisation brings environmental externalities such as a reduction in green spaces, an increase in ecological fragility, growing air pollution, destruction and fragmentation of agricultural lands on the outskirts of cities and disconnection between urban dwellers and

the natural environment (Meng 2019; Albaladejo-García et al. 2021). A reduction in urban green space as well as recreation and natural tourism centres and the disconnection of urban residents from the natural environment can lead to a decline in the well-being (Cao and Li 2024), mental health reduction (Elrafie et al. 2023; Werder et al. 2024) and mental fatigue (Li et al. 2024; Osa et al. 2024) of citizens. One of the solutions to address these problems is urban agriculture, which can be considered a new solution to address the environmental, economic and social challenges of cities. Additionally, "urban agriculture" can be promoted as an effective way to ensure food security (Steenkamp et al. 2021; Slater and Birchall 2022; Desalegn et al. 2024).

Urban agriculture plays a significant role in preserving natural and semi-natural landscapes and areas around cities (Contesse et al. 2018; Zabala et al. 2021). Urban agriculture and horticulture create green spaces in and around cities (Azunre et al. 2019) and improve social well-being (Rao et al. 2022). In many cities worldwide, the development of urban agriculture has become one of the fundamental and important features of urban planning and, in addition to its complementary role in providing food, it also plays other effective and beneficial roles in the framework of urban life (Alivand 2022). Urban gardening is one of the dimensions of urban agriculture in which a group of city residents or around the city are engaged in gardening in a plot of land and there is an element of collective action in it. In general, due to the contributions of these gardens to food security, economic and environmental sustainability and the protection and creation of green spaces (Azunre et al. 2019), the multipurpose role of these gardens has been accepted (Orsini et al. 2013).

According to their location and management model, there are different types of urban gardens, such as allotment gardens, home gardens, community gardens (CGs), school gardens, as well as balcony and rooftop gardens (Ferreira et al. 2018; Kwartnik-Pruc and Droj 2023). One type of urban garden is community gardens (CGs). This type of urban garden, as an asset of a city, provides various ecosystem services (ESs), such as preserving biodiversity (Cabral et al. 2017) and creating habitats for various species (Speak et al. 2015), food production (Song et al. 2022), adjusting the local climate (Tsilini et al. 2015), regulating water and runoff (Breuste and Artmann 2015), cooling through evaporation and transpiration (Knight et al. 2021), providing agricultural education and understanding of agronomic knowledge (Ding et al. 2022), improving health (Li et al. 2024) and recreation (Bretzel et al. 2018) and creating social cohesion in cities (Barthel et al. 2013). CGs improve the quality of a city's social environment by enhancing participation, creating social cohesion, providing educational activities and strengthening social structures (Chalmin-Pui et al. 2021; Rao et al. 2022). Note that CGs were formed in the early 19th century to deal with food insecurity and reduce the effects of poverty in Europe (Keshavarz and Bell 2016). The wide range of services of CGs has increased the interest of policy-makers, social organisations and researchers in this issue (Kingsley et al. 2019; Doyle 2022) and CGs have been accepted as a significant tool in sustainable urban development (Alivand 2022). Investigating the uses and services of CGs can be useful in designing local policies and urban management (Egerer et al. 2024).

Neglecting the importance and not understanding the real value of the environmental as well as socioeconomic services of CGs in many developing countries, including Iran, has led to a lack of planning for the creation and

development of this type of urban garden. Many city managers, with a pessimistic view, believe that this innovation does not have feasibility in the urban green space. Additionally, many decision-makers consider the creation of CGs, AGs and other types of urban gardening and farming in cities to be political gestures or luxury entertainment and do not accept them as practical plans for sustainable urban development (Alivand 2022). One of the reasons for such a view is citizens' livelihood and economic hardships together with the existence of other political priorities for city management in developing countries, which cause the social, economic, environmental and cultural services and benefits of CGs to be neglected.

One of the most important elements of the development of urban CGs, especially in developing countries, is the understanding of their ESs by consumers and the formation of demand, based on consumer preferences. Indeed, without potential demand, planning to create a CG will fail. Analysing consumer preferences and investigating the existence of a potential market, especially in developing countries such as Iran, which have not yet had the experience of creating a CG, can help in policy-making and planning for city managers to create and operate CGs. Additionally, studies in this area, while informing decision-makers, allowing them to be more efficient in urban planning and making decisions, are accepted by the majority of citizens (Albaladejo-García et al. 2021).

Since there is no CG in many developing countries (Alivand 2022; Zheng et al. 2022), one way to investigate the existence of potential demand is to use economic valuation methods and estimate people's WTP. Economic evaluation provides the possibility of estimating the demand for CG to benefit from the expected ESs of these agricultural systems. It also estimates the social, economic and demographic factors affecting the demand and WTP of citizens (Ye and Yoshida 2019). Estimating the social demand for this type of urban garden leads to creating a specific legal framework that citizens will widely accept (Ribeiro et al. 2020).

A review of literature shows that economic valuation studies on the social-environmental benefits and services of allotment and community gardens is very limited (Scott et al. 2018; Albaladejo-García et al. 2021). There is extensive literature on the WTP, economic value and welfare effects of other types of natural urban ecosystems, such as parks (Latinopoulos et al. 2016; Halkos et al. 2022; Silva et al. 2022; Yousofpour et al. 2024), forests and forest parks (Chen and Qi 2018; Kim et al. 2021; Zegeye et al. 2023), as well as other types of urban green spaces (Xu et al. 2020; Gelo and Turpie 2021; Salm et al. 2023). Numerous studies have also been conducted regarding socio-economic factors (such as age, household expenses, gender, income, education, environmental attitudes etc.) and spatial factors (residence location, distance to recreational places and green spaces, distance to alternative places, air pollution status) affecting the willingness to pay and demand for urban green spaces (Tiraieyari et al. 2019; Ye and Yoshida 2019). Additionally, there are many studies regarding different fields of urban agriculture (Ayoni et al. 2022; Yuan et al. 2022; Pradhan et al. 2023), urban gardens (Čepić et al. 2024), ecosystem services of allotment and community gardens (Cabral et al. 2017; Haase and Gaeva 2023), barriers to the creation and development of social gardens (Asl and Azadgar 2022; Ding et al. 2022), socio-psychological effects of allotment and community gardens (Young and Bauer 2022) and other issues related to community gardens

(Raneng et al. 2023). However, in few studies in developing countries, the potential demand and people's WTP to create CGs and the economic valuation of CG ecosystem services have been investigated (Albaladejo-García et al. 2021).

The purpose of the present study is to explore the potential demand and estimate the WTP for creating and exploiting the ecosystem services of CGs, identify the factors affecting the demand and determine the total economic value of the ESs provided through the creation of CGs in barren and abandoned urban lands of Dezful City, Khuzestan Province, Iran. For the following reasons, this study can contribute to the development of the limited literature on estimating the demand and preferences of citizens for community gardens and valuing the resulting ecosystem services:

1. In the Middle East countries, no study has been done regarding the estimation of demand, willingness to pay for the creation of CGs and the valuation of its resulting ecosystem services. Thus, the results of the present study can answer this gap and serve as a guide for other developing countries.
2. The valuation method used in this study is the Choice Experiment method, based on the stated preferences approach, which, unlike methods such as contingent valuation (CV), can valuate multiple ecosystem services and analyse citizens' preferences regarding each of them. In addition, this method can identify which of the CG ecosystem services for citizens has more importance and higher value (by estimating the WTP for each of them). The understanding of this issue by policy-makers and decision-makers of urban management leads to more efficient urban planning and is accepted by the majority of citizens.

Due to the lack of CGs in Iran and, accordingly, the lack of knowledge about the issue amongst urban decision-makers, as well as awareness about the acceptance or non-acceptance of CGs by citizens, together with the novelty of the investigated issue and the lack of similar domestic research on the WTP of people for the use of CGs, the present study tries to provide an appropriate response to this information and research gap.

Methods

The choice experiment (CE) method was used for investigating the objectives of this study, which, in addition to valuing ecosystem services (ES) and estimating citizens' willingness to pay (WTP), also estimates the factors affecting the WTP for valued attributes and ESs. The following subsection provides more details on the study area, theoretical foundations of the CE, experimental design, data collection and model estimation.

Study area

Dezful County is one of the counties of Khuzestan Province and is located in south-western Iran. The area of this county is 4762 km^2, which is located at 48°20' to 48°31' longitude and 32°22' to 32°57' latitude. As a major part of the Khuzestan Plain, Dezful is one of the most populated cities in Khuzestan Province due to its fertile lands and the presence of the Dez River, which runs

through the centre of this city and it has significant potential for creating and exploiting the capacity of CG. This city has a Mediterranean winter and autumn and its green ecosystem is very pleasant from early autumn to early spring. In addition to fertile plains in the central and southern regions, it has foothills and spectacular mountains in the north. The minimum and maximum temperatures in this area are between 2 and 50 degrees Celsius (Eidipour 2023).

However, the development of urbanisation and suburbanisation has reduced urban green space and the presence of abandoned and unused land in some old parts of the city has distorted the beauty of the city. The emergence of CGs in potential cities such as Dezful can play a significant role in reviving waste and unused lands. The presence of a river with rich water resources and suitable weather conditions can accelerate the creation of CGs and their ecosystem services (Eidipour 2023). Fig. 1 shows the geographical location of Dezful city.

Choice experiment method

The choice experiment is a valuation method based on stated preferences, in which people are asked to state their preferences for different attributes of goods in a hypothetical market by creating alternative hypothetical scenarios, as well as offering non-market goods and services at different levels and attributes (Petcharat et al. 2020). Each "good" alternative has several attributes with different levels. One of the reasons for using this method for valuation in the current study is that CG provides multiple ecosystem services, each of which has value and the CE method (unlike the conditional valuation method) provides the possibility of estimating the value of several attributes at different levels.

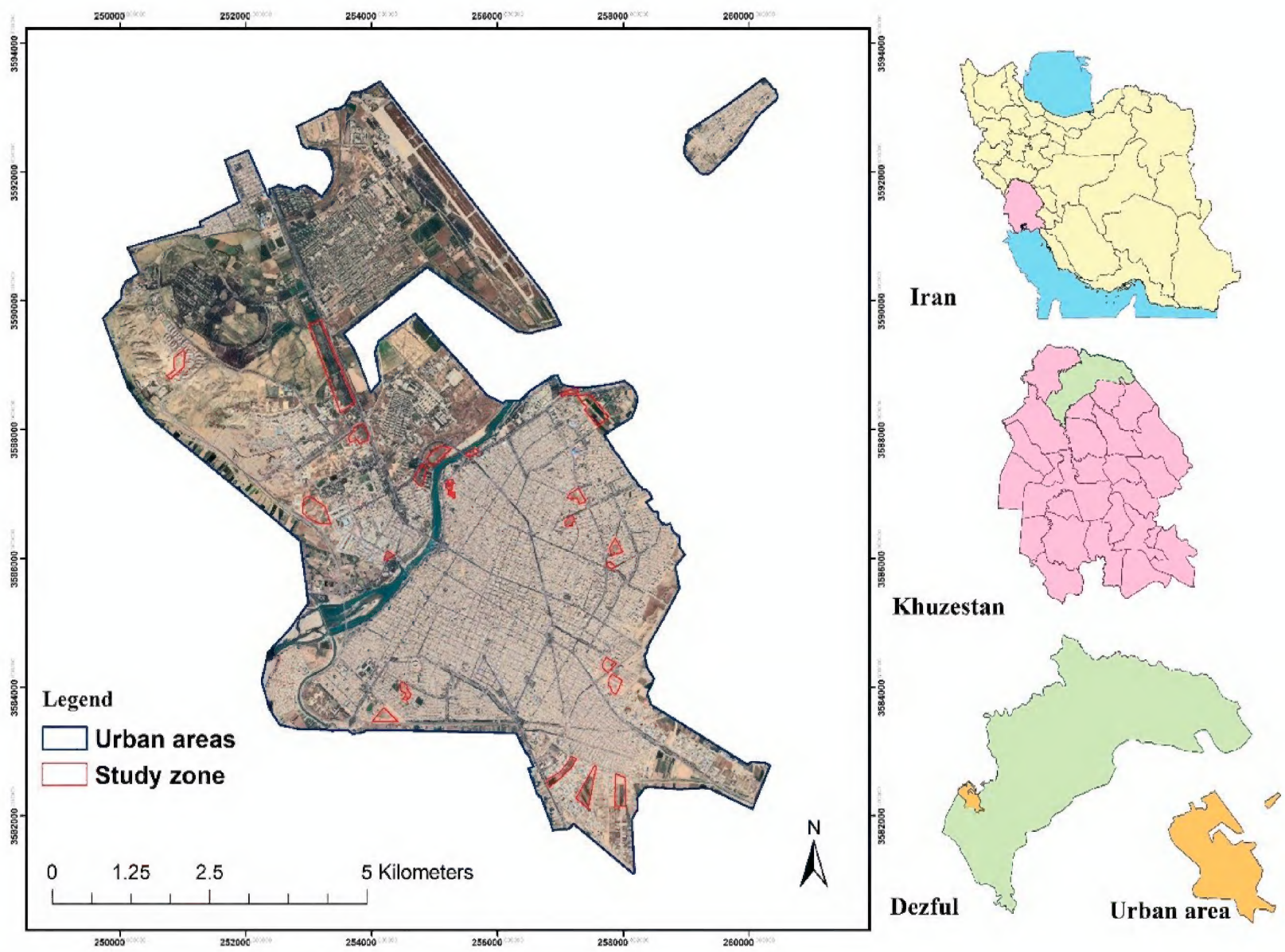

Figure 1. Geographical location of the study area.

Theoretical foundations of the choice experiment

The theoretical basis of the choice experiment method is Lancaster's characteristics theory of value, random utility theory and experimental design (Hanley et al. 1998). According to Lancaster's theory of demand, the total utility of a product or service is equal to the sum of the utilities of each of the characteristics of that product (Lancaster 1966). The random utility model assumes that people gain "utility" from choosing a product or environmental attribute (choosing an option) (Aguiar et al. 2023). In this framework, the choice of each option is shown by the differences between a set of alternatives (Petcharat et al. 2020). In the random utility model, each alternative (options A and B or alternatives to the status quo) is described by a utility function that has a deterministic component (V_i) and a random error component, being expressed as Equation (1) (Salm et al. al. 2023):

$$U_i = V_i + \varepsilon_i \tag{1}$$

It is assumed that a person chooses an option or an alternative that has a higher utility. For example, a person chooses alternative i if $U_i > U_j$ for all $i \neq j$. Since utility has a random component, the probability of choosing alternative i by an individual can be expressed as follows (Caporale et al. 2024):

$$Pr_i = Prob\left\{ V_i + \varepsilon_i > V_j + \varepsilon_j ; \forall j \in C \right\} \tag{2}$$

where C is the choice set amongst the possible options and the variable V_i includes the attributes of the situation. In this study, there are three options (current situation, option A and option B). It can be shown that, if the error terms ($\varepsilon_j \varepsilon_j$) have standard type I extreme value distributions which are independently and identically distributed, the probability of choosing option i by the respondent is expressed as follows (Maddala 1983):

$$Pr_i = \frac{\exp(\lambda V_i)}{\sum_j^j \exp(\lambda V_j)} \tag{3}$$

This distribution is specified by the scale parameter λ, which is inversely dependent on the variance of the error term and the location parameter δ (Petcharat et al. 2020). It is assumed that the chosen distribution is the standard Gumbel distribution with λ = 1 and δ = 0 (Ben-Akiva and Lerman 1985). Assuming that the systematic component of utility is linear, the utility function for alternative i can be defined as Equation (4):

$$U_i = \alpha_i + \sum_{j=1}^{n} \beta_j X_j + \sum_{k=1}^{m} \theta_{ki} Z_k + \varepsilon_i \tag{4}$$

In the above relationship, coefficient α_i indicates the "opt out" or "status quo" option, X_j represents the attributes or ecosystem services related to each option, Z_k is a vector of individual socioeconomic characteristics, ε_i shows a component of random error and β_j and θ_{ki} are estimated parameters of the model (Liu et al. 2019). Finally, citizens' WTP for benefitting from the attributes or ecosystem services of CGs can be calculated through dividing the coefficients of the ecosystem attributes by the price attribute, which is expressed as follows (Salm et al. 2023):

$$WTP_j = \frac{\beta_j}{\beta_{price}} \quad (5)$$

where β_j is the coefficient of the selected attributes and β_{price} is the coefficient of price, rent and input rate or municipal tax for each household per month.

Experimental design

The purpose of this study is to examine the preferences of citizens and the existence of a potential market to determine the economic value of ESs and to estimate citizens' WTP and the factors affecting it in the City of Dezful, Iran. For these purposes, the CE method was used to determine the value of the attributes and ESs of the CG. Since no CG currently exists, the "status quo" is the absence of a CG, where two levels of creating CGs (options A and B) were designed and presented to the respondents. In the questionnaire, along with the complete introduction of the CG and its extensive environmental and socio-economic services, the ESs of options A and B were explained. It was stated that these two options can improve the urban environment. Each of the three available options is described by four ecosystem attributes, which can be assigned to the existing status (status quo), good and excellent level and citizens can state their WTP for each of the ecosystem services with defined levels using the price attribute (with different levels). According to literature and studies conducted with the CE method, the evaluation with this method has four main stages (Petcharat et al. 2020): selecting attributes and attribute levels, creating choice sets, drafting questionnaires and pretests and conducting surveys.

In the first stage, attributes and ecosystem services were selected by referring to literature and other studies, subject to geographical, local and climatic features, as well as services of other gardens in the study area. The first attribute is recreation and nature or urban tourism, which is a kind of cultural service offered to citizens through the natural environment of these gardens. The second attribute is the presence of natural landscapes and beautiful perspectives in the city, which are provided by the green space of these gardens. The third attribute is protecting water and soil resources (preventing soil erosion and helping water infiltration through vegetation cover in unplanted and abandoned urban lands), which is a regulating service. The fourth attribute is access to healthy, organic, nutritious and fresh food, which is realised through the allocation of CGs to citizens for urban agriculture and is considered a type of provisioning service. Each of these four attributes has three levels: no change, good and excellent. Additionally, the price attribute was designed with payment options of 750,000 Rials (2.19 USD), 1,000,000 Rials (2.92 USD), 1,200,000 Rials (3.51 USD) and 1,500,000 Rials (4.39 USD), which actually show the WTP and the subjective value of CG ecosystem services amongst citizens. The attributes (ESs) and their levels are presented in Table 1.

The questionnaire was designed after this stage. Each questionnaire has three parts (Baniasadi et al. 2016). The first part of the questionnaire examined and measured the respondents' level of awareness of CG and its services and investigated their attitudes towards natural resources, the environment and urban green space. In the second part of the questionnaire, while defining and expressing the background of the CGs, all attributes and ecosystem services

Table 1. Attributes (ES resulting from the creation of a community garden) and related levels.

Attribute	Level
Recreation and tourism	Status quo: Absence of community garden and EC resulting from it, the existence of desert, abandoned and unused lands
	Good: Increasing the urban tourism environment by converting 50% of the potential lands into community gardens
	Excellent: Converting all unused urban land into a community garden and significantly increasing the tourism environment
Beauty and landscape	Status quo: Absence of community garden and EC resulting from it, the existence of desert, abandoned and unused lands
	Good: Just a little of green landscape and reducing boring and polluted landscapes
	Excellent: Green landscapes, favourable vegetation, absence of boring and polluted landscapes
Protection of natural resources (water and soil)	Status quo: Absence of community garden and EC resulting from it, the existence of desert, abandoned and unused lands
	Good: Moderate destruction of base natural resources (reduction of destruction)
	Excellent: Conservation of water and soil resources (favourable situation)
Access to healthy and organic food	Status quo: Absence of community garden and EC resulting from it, the existence of desert, abandoned and unused lands
	Good: The people of the region only have access to fresh food
	Excellent: Access of the people of the region and other regions to healthy, organic and fresh food
Price (exploitation fee or municipal tax)	0, 750,000 IRR (2.19 USD), 1,000,000 IRR (2.92 USD), 1,200,000 IRR (3.51 USD), 1,500,000 IRR (4.39 USD)

are presented and, after introducing the product (ES) and creating a hypothetical market, the respondents are asked to express their WTP to create and benefit from the ESs (attributes) of the CG in the form of choice sets (Fig. 2). That is, individuals should choose an option between the current situation without a payment option (a lack of CG) and creating and benefitting from the ecosystem services of the CG in the form of options A and B with a hypothetical payment based on their preferences. The choice experiment part includes eight choice sets, with four attributes and three levels of "status quo", option A and option B in each choice set. Fig. 2 presents an example of a choice set in the questionnaire.

The third part of the questionnaire also included personal information and socioeconomic characteristics of the respondents. In the next step, to determine the sample size as well as to modify the original questionnaire and the bid-amounts, a pretest was conducted through interviews with 30 citizens. In the last stage, the questionnaires were completed through face-to-face interviews. The sample size was obtained from Equation (6) presented by Orme (1998) to determine the sample size in the CE method (Rose and Bliemer 2013; Baniasadi et al. 2016).

$$N = 500 \times \frac{N_{lev}}{N_{alt} \cdot N_{set}} \tag{6}$$

In the above relationship, N_{lev}, N_{alt} and N_{set} are the maximum number of attribute levels, the number of alternatives in the choice set and the number of the choice set, respectively. Based on Equation (6), the minimum sample size was 83 respondents and 170 respondents were interviewed for statistical certainty. According to eight choice sets and three options (alternatives), a total of 4080 observations were created.

Model estimation

For the data analysis, the conditional logit model and Maximum Likelihood estimation method were used (McFadden 1973). The data from interviews with 170 citizens were analysed using Stata 14 software. The estimated coefficients

Attribute	Status quo	option A	option B
Recreation and tourism	**No change:** Lack of CG	**No change:** Similar to the status quo	**Excellent**: Converting all unused urban land into CG
Beauty and landscape	**No change:** Lack of CG	**Good**: A little of green landscape	**No change:** Similar to the status quo
Protection of natural resources (water and soil)	**No change:** Lack of CG	**No change:** Similar to the status quo	**Good**: Reducing erosion
Access to healthy and organic food	**No change:** Lack of CG	**No change:** Similar to the status quo	**Excellent**: Healthy, organic and fresh food production
Payment (rent, exploitation fee or municipal tax)	0	750,000 IRR	1,000,000 IRR
Please choose the most appropriate	☐	☐	☐

Figure 2. An example of the choice set in the questionnaire.

related to personality and socioeconomic characteristics show the factors affecting citizens' WTP and their preferences towards accepting or not accepting the options of creating a CG. Additionally, the estimated coefficient related to the bid amounts (monetary attribute) has been used to estimate the WTP of citizens, which was explained in the subsection "Theoretical foundations of the Choice Experiment" (equation 5).

Results

Characteristics of the respondents

In this study, 170 household heads were interviewed. Since in the study area, the majority of household heads were men, the majority of the respondents were men accordingly (90.6%). The average age of the respondents was 44 years and young people (20–35) constituted only 15.3% of the sample. The average years of education of the respondents were 14.88 years and they mostly had a bachelor's degree. The average income of the respondents was 111.3 million Rials (269.6 USD) per month and the majority of the respondents (66.5%), after explaining the attributes and ecosystem services of CGs and changing the face of the city following the construction of CGs in the barren and abandoned urban lands, were willing to pay for the construction and protection of the CGs. Some socioeconomic characteristics of the respondents are presented in Fig. 3a–f.

Considering the novelty of the CG issue in developing countries and the absence of CG in Iran, first, the community garden, along with its attributes and ecosystem services, was fully explained to the respondents. Then, they were asked to what extent they knew this information and had knowledge about this type of urban green space.

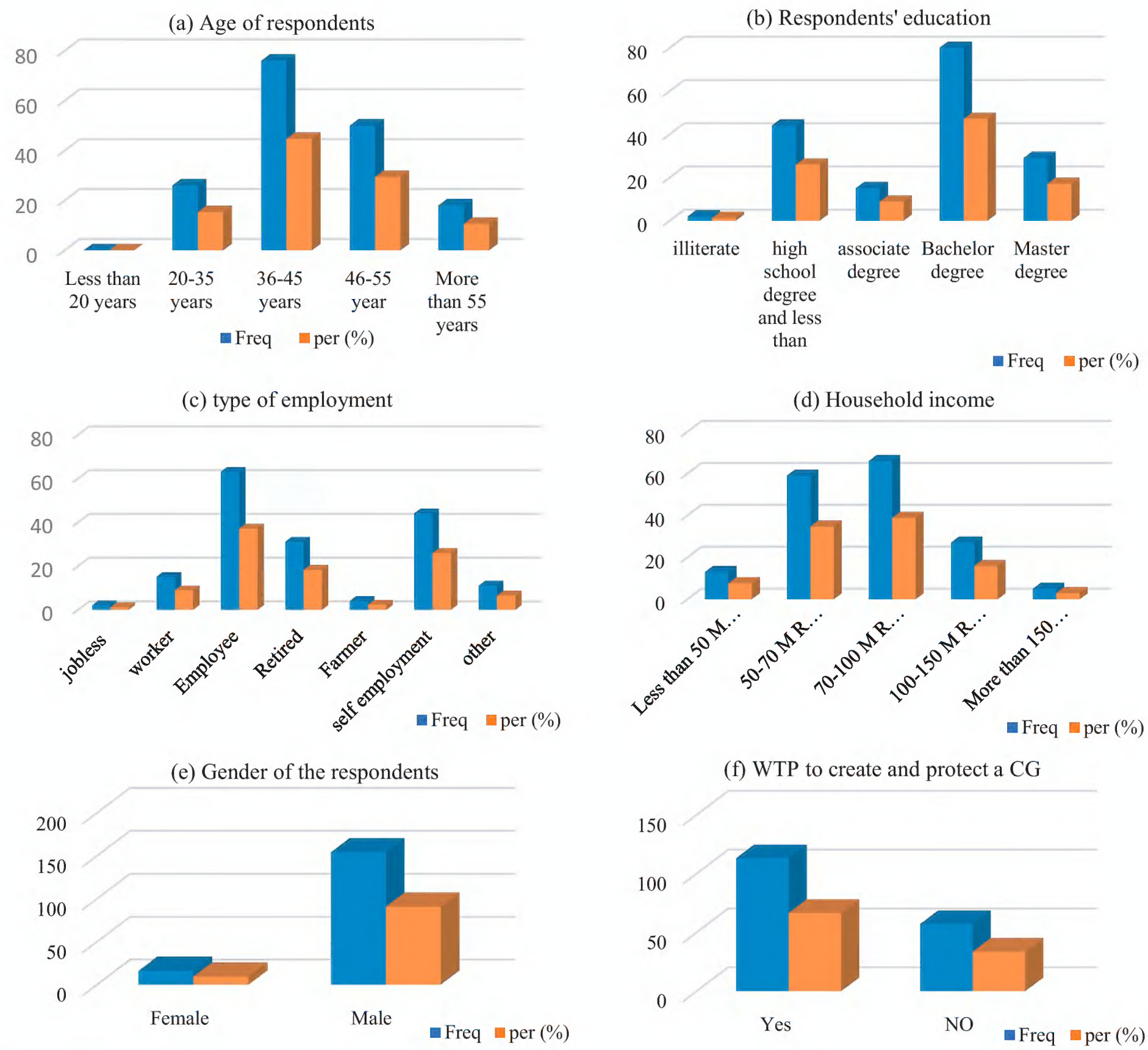

Figure 3. Socioeconomic characteristics of the respondents.

According to Table 2, the majority of respondents, that is, approximately 89.4% of individuals, stated they were unaware of the CGs or their attributes and services or, if they had partial information, most of the described details were new to them. Amongst the respondents, only one person had full knowledge about CGs and their ESs in the urban environment.

Table 2. Awareness and understanding of the community garden.

Knowledge and understanding of the subject (newness of the subject in Iran)	Number	Percent
It was completely new	61	35.89
It was new	49	28.82
Little of it was new	42	24.71
I knew a little	17	10
I knew completely	1	0.58
Total	170	100

Measuring preferences, tendencies, attitudes about CGs and urban green space

After explaining the attributes and ES of the CG together with the experience of developed countries in creating various types of urban gardens (such as community, allotment gardens etc.), the attitude and preferences of the respondents towards the urban green space and some ecosystem services of the CGs were evaluated, with the results reported in Table 3.

First, the first item about the disadvantages of the existence of barren and unused land in the urban space was proposed. More than 99% believed that the existence of such land makes the city look ugly and can lead to social insecurity. Items 2, 3 and 4 referred to provisioning (food production, food security), regulating (air regulation) and cultural (public participation, social solidarity, recreation, urban beauty) ecosystem services. For all these items, more than 85% of the respondents agreed or fully agreed. Additionally, the majority of the respondents (29.42% agree and 70% completely agree) believed that, since the natural environment, from the habitat provision point of view, is dependent on the vegetation cover (supporting ES), the urban ecosystem should also have a share of the vegetation cover. More than 90% of respondents believe that, if natural resources and the environment are exploited, these valuable resources should be preserved for future generations.

The evaluation of respondents' opinions indicates that the majority of individuals are environmentally friendly. They believe that CGs can change the urban atmosphere of Dezful City and provide ecosystem services. This attitude shows the existence of a potential market for creating and operating

Table 3. Measuring tendencies, attitudes and preferences about the environment and urban green space.

Items	Percentage of respondents					Mean (0–5)	St. Dev.
	Completely Disagree (Score: 1)	Disagree (Score: 2)	Indifferent (Score: 3)	Agree (Score: 4)	Completely Agree (Score: 5)		
1) The existence of barren and unused urban lands has led to the ugliness of the city's face and can create an environment of social insecurity.	0	0	0.58	35.89	63.53	4.63	0.49
2) The increase in green space and vegetation will lead to air conditioning in the city, beautiful scenery and a healthy environment for walking and recreation.	0	0	0.58	24.12	75.30	4.75	0.45
3) The existence of a CG (according to its attributes and services) can lead to an increase in public participation and social solidarity.	0.58	0	5.9	49.41	44.11	4.36	0.65
4) Creating an environment inside the city for citizens' agriculture, in addition to helping production and food security, can cause employment and citizens' health.	1.77	4.71	7.05	51.76	34.71	4.13	0.87
5) Considering the dependence of the natural environment on vegetation, the urban ecosystem must also have a share of vegetation	0	0	0.58	29.42	70.00	4.69	0.47
6) Exploitation of natural resources and the environment to generate income, recreation and increase the well-being of the current generation should be accompanied by investment to preserve the environment for future generations.	2.35	0	4.70	40.60	52.35	4.41	0.79
7) I have to pay for the protection of natural resources even if I do not use or see them.	7.64	16.48	28.24	31.17	16.47	3.32	1.16

community gardens. For the last item, "I have to pay for the protection of natural resources even if I do not use or see them", 47.64% of people chose the agree and completely agree on option, 24.11% of people chose the disagree or completely disagree option and 28.24% of people chose the indifferent (neither agree nor disagree) option. Additionally, part (f) of Fig. 1 shows that 66.5% of the respondents tended to pay to create, operate and maintain a community garden, which indicates the existence of a potential market and consumer preferences for a community garden.

Conditional logit model

To calculate the WTP, two models were estimated: the conditional logit model with only environmental attributes and the second model with socioeconomic variables. Table 4 presents the estimation results of both models.

According to the results of models 1 and 2, the environmental attributes "recreation and tourism", "beauty and landscape" and "access to healthy and organic food" are significantly positive. The significance of the first two attributes reveals that the respondents believe that the creation of a CG has led to the improvement of the green space and the beauty of the city and, while adjusting the air of the city, it has led to an increase in urban tourism and the formation of an environment for recreation and sports. The significance of the attribute "Access to healthy and organic food" also shows that the respondents believe that the creation of a CG in the city leads to an increase in access to healthy and organic food. The positive sign of these attributes also indicates that improvement in these ecosystem services leads to an increase in citizens' WTP. The attribute "protection of natural resources" is not statistically significant, demonstrating that, from the point of view of the respondents, CG does not lead to the preservation of basic water and soil resources.

Table 4. Estimation results of the conditional logit model.

variable	Model 1			Model 2		
	Coefficient	Z-Statistic	P-Value	Coefficient	Z-Statistic	P-Value
Recreation and tourism	0.3055	4.11	0.000	0.4005	5.21	0.000
Beauty and landscape	0.3245	4.96	0.000	0.2601	3.80	0.000
Protection of natural resources (water and soil)	0.1778	0.27	0.787	-0.2793	-0.43	0.668
Access to healthy and organic food	0.2096	3.63	0.000	0.2213	3.80	0.000
Price	-0.00011	5.45	0.000	-0.00002	-7.53	0.000
Age				-0.4287	-7.38	0.000
Being native				1.1082	4.48	0.000
Education				0.0547	2.73	0.006
Household expenditure level				0.0311	2.22	0.026
Awareness and recognition of ES of the CG				0.6018	8.92	0.000
Number of visits of urban green space				-0.0429	-8.31	0.000
Good fit criteria of model						
LR (likelihood ratio test)	56.38 (0.000)			41.261 (0.000)		
Log likelihood	-1465.92			-1363.41		
No. respondents	170			170		
No. observation	4080			4080		

The socioeconomic variables in the second model show that people who are younger, native, have a higher level of education, a higher level of living expenditure and are more aware of CG have greater WTP for the creation and operation of CG. These variables are significant with an expected sign. However, the variable "number of visits to urban green space" is significant with a negative sign, indicating that people who visit more urban green spaces have less WTP for the creation of CG. Additionally, the price variable is significant, with expected sign, showing that the lower the bid-amount is, the greater the probability of accepting the bid amount.

WTP estimation

After estimating the coefficients of each of the attributes and bid-amount (price) variables, the citizens' WTP was estimated, with the results outlined in Table 5.

According to Table 5, the highest WTP of the household, equal to 2.07 USD, is related to the "recreation and tourism" attribute, followed by the "beauty and landscape" attribute, which is equivalent to 1.35 USD in second place and "access to healthy and organic food", which is in third place, with 1.15 USD per household per month. The lack of significance of the attribute "protection of natural resources" indicates that the citizens of Dezful City believe that CG does not lead to the preservation of water and soil resources, so they do not value this attribute. The sum of the above three amounts, equivalent to 4.57 USD, indeed shows the total WTP for a household in Dezful City to benefit from the ecosystem services of the CG. According to the latest data obtained from the Iranian Statistics Center, 134,730 households live in Dezful City and, based on the data collected from the sample, 66.5% of them are willing to pay to create and operate a CG in Dezful City. Thus, it can be estimated that the people of Dezful City are willing to pay 4.91 million dollars annually for the creation and operation of CGs.

Discussion

The current study aimed to estimate the WTP of people for the creation and operation of a CG in barren and abandoned urban lands in the City of Dezful in south-western Iran. Since plots of land have been left unused in different parts

Table 5. The WTP of people for the creation and operation of a community garden (Rial/Dollar).

Attributes	WTP (Person/Month)		WTP (Household/Month)		WTP for the entire area per month		WTP for the entire area per year	
	IR* Rial	US dollar	IR Rial	US dollar	Billion IRR	1000 USD	Billion IRR	Million USD
Recreation and tourism	200,250	0.59	709,250	2.07	63.545	185.8	762.543	2.23
Beauty and landscape	130,050	0.38	460,614	1.35	41.269	120.7	495.224	1.45
Protection of natural resources (water and soil)	Non-significant	–	–	–	–		–	–
Access to healthy and organic food	110,650	0.32	391,903	1.15	35.112	102.7	421.350	1.23
Total WTP for all attributes per year	440,950	1.29	1,561,767	4.57	139.926	409.1	1,679.118	4.91

*- Rial (R) is the currency of Iran. The average US dollar (USD) in 2022 was 342028 Rials (Sources: Central Bank of I.R. Iran).

of the city and dry lands without green spaces have created unfavourable views in the city, the proposal to create a community garden, based on the experience of advanced countries, can lead to a change in the face of the city. Note that abandoned urban land can become a place for all kinds of crimes and endangers social security. Due to having sufficient water resources (the presence of Dez River) and a hot and humid climate, Dezful City has suitable conditions for creating community and allotment gardens. This innovation, for the first time in Iran, can lead to the improvement of environmental indicators and social reconstruction in dry and abandoned urban lands around the Dez River in Dezful City.

The results of this study indicate that the value of the ecosystem services of the CG for the residents of Dezful City is influenced by various socioeconomic factors. Younger people have greater WTP to create as well as operate a CG. The results of the studies of Albaladejo-García et al. (2021) and Lackey et al. (2021) also show that younger people attach more importance to cultural services such as recreation, tourism and education and, therefore, have greater WTP. Additionally, people with higher education levels were willing to pay more to create a CG in Dezful City. People with higher education, due to their greater awareness of the importance of environmental issues, are willing to pay more to protect the environment and create urban green space (Xu et al. 2020; Idris et al. 2022).

The evaluation of the ecosystem services of creating a CG indicates that people who have a higher level of living expenditure are willing to pay more for the creation of a CG. Since people in developing countries do not state their real income level, the expenditure level is used as a proxy of people's income in the model. Other studies, such as Albaladejo-García et al. (2021) and He et al. (2016), have confirmed the positive relationship between higher income (expenditure level) and WTP. He et al. (2016) believe that people with higher incomes consider urban green space to be an available option for recreation and tourism and are therefore willing to pay more.

The results indicated that native people have a greater WTP than non-native people and immigrants from other cities or provinces. The main reason for this could be their permanent residence in Dezful, greater benefit from ecosystem services and spatial dependence as well as a sense of belonging to the homeland. The results also revealed that the variable "awareness and recognition of ESs of the CG" led to an increase in WTP. Indeed, citizens who have more accurate information about CG ecosystem services have greater WTP (Meng 2019). In particular, those who have been studying more about the experiences of advanced countries in this new type of urban service have learned more about a variety of ecosystem services, such as regulating, provisioning, cultural and supporting services. Some research shows that initiatives, such as community gardens that improve ecosystem services, are significantly important to citizens (Martinez-Paz et al. 2019). Additionally, Albaladejo-García et al. (2021) found that ecosystem services are the main determining factor in valuing all kinds of urban gardens, so citizens' information about these ESs affects their WTP. Similar studies in European countries also confirm this finding (Palau-Salvador et al. 2019).

The statistical significance of the "Recreation and Tourism" and "Beauty and Landscape" attributes demonstrates that respondents believe that creating CGs in Dezful's abandoned and destroyed lands will improve cultural services such as urban beauty, green space, beautiful landscapes and a suitable environment for recreation and tourism. Numerous studies, such as Borysiak and

Mizgajski (2016) and Cabral et al. (2017), have shown that CGs provide cultural ecosystem services.

The attribute of "Access to Healthy and Organic Food", which is one of the provisioning ESs of CGs, also affects individuals' WTP. The results of Adekunle (2013), Church et al. (2015) and Albaladejo-García et al. (2021) showed that provisioning services, such as food production in CGs, lead to increased welfare for elderly people. Similarly, Partalidou and Anthopoulou (2017) argued that urban gardens, including CGs, help improve the food security of low-income households. The production of food and agricultural activities in communities and allotment gardens in urban environments provide physical mobility and vitality for all individuals, especially elderly individuals. The production of healthy and organic products can also improve the food safety of urban households.

The model results showed how much understanding of CG ecosystem services is effective in the economic evaluation of CGs. Due to the lack of CGs in Iran thus far, there may be no understanding of CG ecosystem services amongst citizens, so the results of the study are obtained according to the creation of a hypothetical market, the expression of CG ecosystem services as well as similarities to the types of urban gardens and green spaces. Indeed, after the construction of the community garden and its exploitation, citizens will develop a more accurate understanding, awareness and knowledge of the CG and its ecosystem services. Tian et al. (2020) also found that understanding and awareness of ecosystem services provided by urban green spaces, including CG, affect citizens' WTP.

The WTP of households in this study was 4.57 USD per month, which is a significant figure for citizens of developing countries under international sanctions. To better understand this number, it is worth noting that in a similar study of allotment garden valuation in Spain, the figure of 5.4 (€) euros (equivalent $5.7) for the ecosystem services of CG was estimated to be close to the WTP in this study. In another study, Petcharat et al. (2020) estimated that the WTP for Bangkok's largest urban green space was $42 per year, equivalent to $3.5 months/household.

Due to the population of Dezful City and the percentage of the sample studied who would be willing to pay for the creation of a CG, Dezful citizens are expected to pay $409.1 thousand monthly and $4.91 million annually to create and benefit from CG ecosystem services. These amounts can generate significant income for the municipality and cover the operating plus maintenance costs of CGs. This financial source can separate the construction of a CG by the municipality from the public budget. The sustainability and continuity of CG will not depend on the public budget.

Conclusions

This study is important as there are not all kinds of community, allocation etc. gardens in Iran and estimating the WTP as well as analysing the stated preferences of consumers can be useful for directing and starting construction projects for this type of urban garden. Socioeconomic valuation of the creation and exploitation of CGs in barren, unused and abandoned urban lands has not been carried out in Middle Eastern countries thus far and has not been emphasised in economic valuation studies in this region. Valuation studies and projects are suitable not only for estimating the value of non-market benefits of creating

CGs, but also as a tool for understanding citizens' preferences, opinions and public beliefs about environmental issues (Martínez-Paz et al. 2021). Thus, the present study can help urban planners better understand the preferences of citizens and this understanding will lead to decisions to improve social welfare.

In this study, cultural services (beauty and landscape, recreation and tourism) were valued most highly by citizens, followed by provisioning services (healthy and organic food production). Therefore, citizens pay special importance to urban green space. However, the creation of large dimensions of urban green space has a significant financial burden. The estimation of social preferences reveals that the construction of a CG, in addition to providing urban green space and providing ecosystem services, can afford its costs because of public participation and, at the same time, generate sustainable income for the municipality. Thus, the construction of such gardens in urban spaces, in addition to the aforementioned benefits, has also economic justification. Accordingly, it is recommended that municipalities take advantage of the assignment or rent of CGs or the entrance fees to them as a stable income and spend this income on the creation and development of CGs in the initial stages. Additionally, granting some facilities to encourage the private sector to convert their lands into CGs, providing the possibility of income earning from CGs and extensive advertising to buy healthy and organic food products produced in CGs, can be effective in the development of CGs.

In addition, the results of the study indicated that citizens attach less value to regulatory services and habitat services or do not care about them (no value). Indeed, citizens care about the ecosystem services that are directly used by them (use ESs) and care less about the non-use values of the environment, while these ESs are very valuable and contribute to the sustainable development of the city. Thus, by informing citizens and providing evidence, it is necessary for policy-makers to explain the non-use values of ecosystem services to citizens and influence their WTP. Studies by Livesley et al. (2016) and Petcharat et al. (2020) also confirm it.

In addition to creating urban green space and providing ecosystem services, CG leads to a decline in social insecurity. Note that abandoned and destroyed urban lands are currently a gathering place for criminal and addicted people, but when they become CG, they bring with them sustainable social security. At the same time, CG can become a place for agricultural education and sports for elderly people and provide the basis for enhancing social cohesion and the growth of social activities. As such, it is necessary to identify and evaluate the social effects and benefits of creating CGs in the region in future supplementary studies.

The field survey, municipal documents and the evaluation results of the present study show that, for the creation and exploitation of CGs, there are key elements, i.e. abandoned and apt urban lands (place) and citizens interested in the exploitation of community gardens (people). Nevertheless, it seems that the lack of a legal or political framework is one of the most important obstacles to the creation and exploitation of CGs. Additionally, institutional and legal concepts should have a clear definition (such as "property rights", "land use change", "the method of transfer of ownership" or "the method of transferring the right of exploitation", "the conditions of expropriation" or "prevention of exploitation and reclaiming of land" etc).

Countries with successful urban CGs projects usually have correct policies and appropriate legislations on CGs. For example, countries such as Germany (Act of

Small Gardens 1983), United Kingdom (Allotments Act 1950) and Denmark (Allotment Gardens Act 2001) can be mentioned (Ricci and Conrad 2018). Hence, it is recommended that, for the better implementation of the project of creating CG, legal studies for legislation, as well as proper policy-making in the field of urban land management to create CGs, should be done and policy-makers should use the experiences of leading countries in this field to implement appropriate policies.

Another point that should be noted is that there is another type of urban garden called allotment gardens (AGs), where plots of land are leased to applicants for urban agriculture or other uses. The experience of other countries indicates that the WTP of citizens for this type of urban garden is greater than the WTP for CGs (Albaladejo-García et al. 2021). Therefore, examining the strengths and weaknesses, as well as the technical feasibility of creating this type of urban garden and comparing it with the CG, is proposed as a suggestion for further studies. Another suggestion for future studies is the identification of suitable lands and technical-economic feasibility studies for creating CGs. Soil quality, road access to lands, topographical features, access to water resources and some other issues should be investigated in feasibility studies.

Finally, it should be noted that the present study, in addition to examining the preferences of citizens and assessing the social acceptance of CGs, revealed that the creation and exploitation of CGs can have financial-economic justification and generate a sustainable income for municipalities in developing countries.

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Author contributions

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Data availability

Data will be made available on request.

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